Thesis Project Portfolio

Accuracy in Image Processing Basics to Improve Autonomous Driving Technologies

(Technical Report)

Examining the switch of Tesla's use of Vision AI from Radar & USS, and its Impact on Manufacturing Towards Cost Reduction

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Driving Innovations: The Intersection of Image Processing Accuracy and Vision AI in Autonomous Vehicle Technologies

This study investigated the significant shift in cruise control systems equipped upon modern vehicles, with a focus on autonomous vehicles, and hardware manufacturing for their onboard systems. The study specifically focused on Tesla, who leads the market for electric vehicles, and is known specifically for their advanced cruise control system, known as Autopilot. The emphasis of this research is to examine the risks associated with making cars smarter, more adaptable, and capable of receiving updates that extend their capabilities and lifespan beyond initial manufacturing constraints, compared to internal combustion cars found on the market. These constraints could slow them down and cause more issues than traditional systems. Ultimately, this study dissects the decision to replace traditional radar and USS with camera-based vision AI technology in attempts to achieve better accuracy. This strategic move also leans towards a vision-centric system in hopes for cost reduction in manufacturing processes and the enhancement of vehicle functionality and safety. The study argues that this change aims to reduce reliance on expensive hardware sensors and allow it to be easier to streamline production processes, encouraging the idea of modern trends towards software-centric automotive design. This approach allows for continuous improvements through over-the-air updates, and more flexibility overall, while drastically reducing manufacturing costs and enhancing vehicle safety at the same time. The study explores the larger issues of this shift on the automotive industry, highlighting how the adoption of vision AI and autonomous systems challenges existing manufacturing standards, supply chains, and question vehicle ownership. Consumer behavior is another area likely to be shifted by the integration of vision AI and autonomous driving technologies. The convenience and safety promised by these advancements could lead to a greater acceptance of car-sharing services, reducing the need for individual car ownership. This technology also has the potential to decrease traffic congestion and emissions, contributing to more sustainable urban environments. It goes into the potential environmental benefits of reducing the need for physical materials and the possibility of decreasing traffic accidents through more accurate vehicle control. The research

examines the impacts of this technological strategy, including consumer perception of the software, road safety, and changing of regulatory frameworks. It incorporates Science, Technology, and Society (STS) frameworks to understand the incorporation of technology and society, focusing on "sociotechnical imaginaries" towards collective visions for future technologies. The study points out the socio-economic challenges created by the adoption of autonomous vehicles, such as potential job displacement in the transportation sector. It also talks about the safety concerns raised by the reliance on Vision AI, focusing on examples where this technology has faced scrutiny from large accidents, including fatal casualties. The research argues for attention to the need for re-examining among innovators, regulators, and the public to figure the issues of integrating advanced AI systems into everyday use, while also making it safe for the average consumer and making this technology standard for both electric vehicles, and for advanced cruise control systems. The research shows a moment in automotive and technological history, where moving towards Vision AI is seen as a complete overhaul of vehicle and navigation technologies that will shape the future.